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JOHNS HOPKINS UNIVERSITY CIRCULARS

Published with the approbation of the Board of Trustees

Vol. XXI.—No. 158.] BALTIMORE, JUNE, 1902. [Price, 10 Cents.

THE ECONOMIC SEMINARY, 1901-1902.

Edited by Associate Professor J. H. HOLLANDER.

The Economic Seminary has met fortnightly during the current academic year under the direction of Associate Professor Hollander, assisted by Dr. Barnett. Its membership has been limited to the most advanced students, and its primary design has been to develop the scientific spirit in economic study so as to facilitate the use of sound methods of economic research. The general subjects of study have been the commercial policies and the industrial institutions of Europe and the United States in the nineteenth century. Each member of the Seminary has prepared and submitted, for detailed criticism as to method and content, a study of some phase of modern economic development, within that broad field.

The proceedings of the Seminary have been as follows:

October 9: Organization and preliminary statement by the Director.

October 16: "State Banks since the passage of the National Bank Act." By Dr. George E. Barnett (published in *Johns Hopkins University Studies in Historical and Political Science,* Twentieth Series, Nos. 2–3).

October 29: "Trust Companies in the United States." By George Cator (published in *Johns Hopkins University Studies in Historical and Political Science,* Twentieth Series, No. 5; cf. also *Johns Hopkins University Circular*, April, 1902).

November 12: "The Financial Reorganization of Porto Rico." By Associate Professor Hollander (published as "The Finances of Porto Rico" in *Political Science Quarterly*, December, 1901, and as "Excise Taxation in Porto Rico, in *Quarterly Journal of Economics*, February, 1902).

November 26: "The Balance of Trade of the United States." By Dr. Fabian Franklin, editor of *The Baltimore Evening News.*

December 10: "Commercial Relations of Japan since 1868." By Yukimasa Hattori.

January 7: "The Financial Administration of Japan." By Kenkichi Kodera.

January 21: (a) "Industrial Arbitration in the United States." By Dr. E. Dana Durand, secretary of the U. S. Industrial Commission.
(b) "Economic Reform and Vested Interests." By Albert W. Rayner.

February 11: "The Hemp Industry in Kentucky." By T. Brent Moore.

February 25: "The Coal Industry near Pittsburgh." By Logan G. McPherson.

March 11: (a) "Colonies and Colonial Commerce." By George Cator.
(b) "The Economic Position of Germany." By Dr. George E. Barnett.

March 25: "The Economic Evolution of Porto Rico." By Dr. F. del Valle.

April 8: "Taxation in Japan." By Kenkichi Kodera.

April 22: "Japan's Foreign Trade since the Restoration, (1868–1900)." By Yukimasa Hattori.

May 6: "The South Carolina Dispensary System." By Porter Hollis.

May 20: Outline and discussion of the work of the Seminary in 1902–03.

THE BALANCE OF TRADE OF THE UNITED STATES.

By Fabian Franklin.

[Report of an address to the Economic Seminary, November 26, 1901.]

Dr. Franklin commented on some recent discussions of the extraordinary balance of trade shown by the statistics of the commerce of the United States in the past four or five years. The very great scale on which this phenomenon of a steady excess of exports over imports has been exhibited, without the existence of anything like a corresponding liability for interest, etc., on the part of the exporting country should draw attention to the importance of a factor perhaps not sufficiently emphasized in the standard discussions of the theory of international trade—the effect, namely, produced during the process of changing the status of a country as regards its debtor-and-creditor relations with other countries. There is no reason why this process should not go on for a considerable period, and during that period have a marked effect upon the trade balance. The United States has evidently, in the past few years, been largely reducing the aggregate of foreign investments here, or largely increasing that of American investments abroad, or both. For a certain length of time, this process may be accompanied by a constant large favorable balance of trade; but this latter effect is, in the nature of the case, necessarily limited in duration. Sooner or later—and, humanly speaking, certainly before a great many years—the amount annually due as interest on the accumulated investments already made abroad must exceed the amount annually added to those investments; when this stage is reached, the balance of trade must turn the other way. This is the condition in which Great Britain has so long been, and which, if anything like the recent excess of our exports over our imports is kept up, the United States must reach in a not very remote future.

THE FINANCIAL ADMINISTRATION OF JAPAN.

By Kenkichi Kodera.

[Abstract of a paper read before the Economic Seminary, January 7, 1902.]

The power to impose taxes and to provide for revenue and expenditure in Japan is vested in the Emperor and the Imperial Diet. The budget is voted annually and passes through four stages in its progress: (1) preparation; (2) legislation; (3) execution; (4) subsequent control.

The Cabinet Council, consisting of the Minister President and the Ministers of State, estimate the amount of revenue and expenditure, and the Minister of State for Finance prepares an annual budgetary bill, upon the basis of reports submitted by each administrative authority of the Empire. The estimates are prepared for the twelve months beginning on April 1.

In the winter session of the Imperial Diet the general budgetary bill is submitted by the Government to the House of Representatives for their consent. The confirmation of the bill takes place, as a rule, after three readings. The bill is then laid before the House of Peers, and is confirmed by the same process as in the lower House. By the sanction of the Emperor the budgetary legislation is then completed, and takes legal effect by promulgation, imposing obligations upon the administrative authorities throughout the Empire. Administrative officers have no power to expend money beyond the amount prescribed in the budgetary law, but they may collect revenue, pursuant to law, beyond the amount so prescribed as the budget simply presents an estimate of revenue.

After the execution of the budgetary law for a fiscal year, the Imperial Diet is empowered to verify the statement of the accounts of the past fiscal year, and the Government lays before the Imperial Diet the final accounts which have already undergone verification by the Board of Audit, together with the report of the said Board thereon. When the final accounts are considered correct, the Imperial Diet discharges the Government from further responsibility. The Bank of Japan and not the National Treasury of Japan is entrusted with the keeping of the treasury funds.

ECONOMIC REFORM AND VESTED INTERESTS.

By Albert W. Rayner.

[Abstract of a paper read before the Economic Seminary on January 21, 1902.]

The general welfare of society is attained by a union of those forces which tend to the betterment of the community in relation to its social and commercial activities. With respect to organized industry, this should take the form of recognition of vested interests.

With the present tendency to organize every branch of industry into great corporations, it follows, that the shareholders include all classes of the community. If sudden and radical changes in customary methods of taxation are introduced, they fall unexpectedly upon a large vested interest who to a certain extent might be properly described as innocent shareholders. They are innocent shareholders in the sense of being the owners of shares in corporations bought under certain existing conditions, namely, faith in the administrators of the corporation and in the recognized legitimacy of the enterprise, and with a knowledge of their investment, based entirely on the statement published by the corporation. In the event of legislative enactment or legal decisions opposed to generally accepted principles, and unfavorable to the corporation, the stockholders must feel the burden.

Modern industry in a broad sense is being developed more by organized bodies than by individual enterprise. It is natural therefore, to find the holdings of over-capitalized stock companies held by institutions, individual shareholders and estates, representing a large class of investors. The holding of securities in the electric and steam railway companies of the United States alone would represent many hundred millions of dollars, and the depreciation of their securities resulting from the imposition of additional taxes, would not alone be an injustice to this class of investors but the ultimate effect of the taxing power thus applied would be felt among many classes of producers.

It is at this point that arises the intricate and serious question of applying correct economic theories of taxation to corporations. This application should be guided by the principle that while there may be a great deal to be said against the present distribution, it will be wise to proceed with caution in advocating radical remedies, and to have regard for a large vested interest whose interest and co-operation keep active the mills of industry, and whose reverses injure the welfare of prosperous communities and nations.

THE HEMP INDUSTRY IN KENTUCKY.

By T. Brent Moore.

[Abstract of a paper read before the Economic Seminary, February 11, 1902.]

Hemp will grow in almost every part of the world, though the yield varies widely, according to soil and climate. Such a soil and climate as are found in central Kentucky are eminently suited to its culture, and here it has been a uniformly successful crop. Its possibilities for the planter are large, consisting in a yield of from 800 to 1600 pounds per acre, together with a small drain upon the soil. Its advantages for the manufacturer consist in the exceeding fineness, strength, softness and whiteness, and general adaptability of the properly dressed lint. Against these, its production involves a heavy expenditure, which, for various reasons, must be estimated in hand labor. Requiring little skill, its production has generally been limited to times of exceptionally high prices, or to rich soils in countries where the price of labor is near the minimum. Every expenditure of care and labor upon it, however, is well repaid.

Between sowing and cutting, no attention is required. Cutting is done either by hand or by an adaptation of the reaping machine. Sowing is either broadcast or by drill. The most costly operation is separating the gum-enclosed fiber from the stalk without tangling. This alone costs about a cent a pound. Three hundred patents have been issued in the United States for machines designed to accomplish this object, but none has superseded hand labor. The resinous gum is removed by steeping in chemical solutions, in pools or streams, or by exposing to the winter rains. The last seems to be the only practicable method in Kentucky. After partially dissolving the gum, the lint is removed by crushing the stalks and beating out the herds. This has hitherto been done by hand, on a portable wooden hand brake, and with great labor. The lint is further dressed by re-steeping, or by crushing it powerfully between smooth rollers, when much of the now friable gum may be beaten out as dust. The lint is then hackled over rows of sharp steel spikes, which remove all remaining herds, and tangled threads. The article may then be bleached and cottonized, or else spun or woven as it is.

Hemp culture was quite profitable in Kentucky when slave labor was used. Though the standard of comfort was probably higher among the slaves than among the peasants of Europe, the greater endurance of the negro would have enabled the Kentuckian to compete easily in the open market, had the planters practiced the thrift of the peasants. The full-grown slave was required to break 100 pounds, or to cut a half acre in a day. Above this task, he was paid at a regular rate. Rivalry in strength, as well as the extra money, stimulated the negro to do his best, which often exceeded 300 pounds breaking, or an acre's cutting in a day. The absorbing love of the free negro for leisure renders labor scarce and inefficient now; otherwise the production of hemp would still be profitable, even at the present prices of hemp and of labor.

THE COAL INDUSTRY NEAR PITTSBURGH.

By Logan G. McPherson.

[Abstract of a paper read before the Economic Seminary, February 25, 1901.]

The market for Pittsburgh coal extends by river to New Orleans and by rail and lake throughout the North and Northwest. Even before its production was arrested by the brief era of natural gas the abundance of coal land, its widely diffused ownership and the little outlay necessary to open a mine had led to over-development. Although new markets had been secured, many mines worked but half time or less even during the prosperity of 1891 and 1892, and the conditions during the succeeding panic grew worse. In the winter of 1896–7, the industry had reached a state of chaos and no man knew what would happen.

The only alternative to a spreading upheaval of liquidation was clearly a consolidation of the different mines under an administration that would secure the economies that result from working in accordance with the natural inclination of the veins, that would assign to each mine the market for which it was best adapted, that would ensure effective oversight by skilled superintendents and engineers, that would save the salaries and commissions of a multitude of sales agents, that would establish a uniform and systematic system of bookkeeping, that would guard against bad debts, give steady work to the skillful and industrious miners and rid the district of the vicious and inefficient.

During the summer of 1899, after two previous unsuccessful efforts a company was promoted to include the rail mines at a capitalization of sixty four million dollars. Mines and mine equipment that but six months before would have been regarded as a sale at one half their rated value were thrown into the combination at two and three times a normal appraisement. Dug out mines, worn out equipment, inaccessible coal lands were included and the enormously inflated securities were quickly absorbed.

The selling price of coal was raised to a point that invited competition which it was endeavored to forestall by large purchases of surrounding coal lands, that would not be mined for generations to come, entailing heavy fixed charges. This policy in a section where coal land is almost co-extensive with the surface needs no comment.

The logical result has followed. New mining companies have opened new mines in coal land through which railroads have been extended. The markets of the combination instead of increasing have diminished. Its annual reports admit an indebtedness that would bear no mean proportion to the assets under liquidation. Indebtedness of many of the combining operators in the banks has been buttressed by securities of the company as collateral and it is an open secret that there have been frequent "wash sales" of stock to maintain its market and therefore its collateral value. The original board of directors has been torn with dissension and the original officers have nearly all resigned. The River company under a different policy has been if not progressive at least not wasteful.

COLONIES AND COLONIAL COMMERCE.

By George Cator.

[Abstract of a paper read before the Economic Seminary, March 11, 1902.]

The mercantile system prevailed at the time of the declaration of American independence, and England, like other European powers, sought to monopolize the trade of her colonies. After the separation from the mother country, the American states traded with Great Britain even more extensively than they had previously done, and it appeared that the restrictive measures formerly in force had not been necessary for the protection of British commerce.

At a later period Great Britain assumed, to some extent, an attitude of indifference towards her dependencies. It was regarded as only a matter of time when the colonies would become independent. This policy resulted in the establishment of distinct fiscal systems in certain of them, and in their release in a great measure from the subsequent control of the home government.

A different feeling now exists. A community of interests is recognized, and a federation is even proposed whereby a close political and commercial union of the British Empire may be formed. In accord with this spirit, the colonies at the outbreak of the South African War furnished troops for the British army, and Canada a few years ago granted preferential tariff schedules on some commodities from the United Kingdom. Such concessions in tariff rates give no practical advantage to the British manufacturer; but they may be significant of a larger movement in the future.

As a progressive country develops, it takes less products from an older country. This has been the case in the United States, and the commercial development of Canada and Australia now indicate the same tendency. Moreover the new countries, as they increase in wealth and importance, may become great sources of supply for the older country. Thus the imports into the United Kingdom from the United States at present amount to more than the combined imports from all the British possessions.

France controls by restrictive measures the commerce of her colonies, but is obliged to meet deficits in their governments. Holland now pursues a liberal policy towards Java, and Dutch commerce, it is claimed, has increased, although the former surplus in the budget has disappeared. China only escapes dismemberment at the present time because of the difficulty of a satisfactory partition among the different contestants. If Chinese markets were open to foreign commerce under liberal conditions, England, Germany, United States and Japan, would compete for the trade. Russia and France could only hope for advantage with the country subjected to their own governments. When China has advanced to a fair stage of economic development, it is impossible to foretell what will be the effect of the competition of her labor supply upon the world's industry.

A review of colonial commerce indicates that colonial trade is governed by general economic laws, and that it does not necessarily follow the flag when uninfluenced by restrictive measures.

THE ECONOMIC POSITION OF GERMANY.

By George E. Barnett.

[Abstract of a paper read before the Economic Seminary, March 11, 1902.]

One of the most important characteristics of the remarkable political and economic development of Germany during the past thirty years has been the rapid growth of population. Since 1870, the number of people has increased from 40,000,000 to 55,000,000. This rate of increase is being maintained. While the birth-rate has fallen since 1870 from 39 per thousand of inhabitants to 36 in 1898, the decrease in the death-rate has more than compensated for the diminution in the birth-rate. The annual rate of natural increase in Germany in 1898, was 14.6 per thousand of inhabitants—a rate greater than that of any other European state except Holland.

Compared with the United States, Russia and the British Empire, Germany presents in one way a marked difference. In the United States and Russia vast tracts of land are not at all or only thinly settled. In her Canadian, Australian, and South African possessions England has homes for future millions of Englishmen. Germany has no colonies to which her surplus population may go and still give strength to the home country. The two and one-half millions of Germans who have emigrated since 1870 have ceased to be Germans.

It has been one of the achievements of the Empire that emigration has been lessened and the natural increase of population employed in home industries. In doing this Germany has become an "industrial state" i. e. a country increasingly dependent on foreign trade for food supply and raw material. The twenty millions of increase in population since 1850 have gone entirely to trade and manufactures. In 1840 the agricultural population of Germany amounted to three-fourths of the whole, in 1900 to only one-third. Germany must sell manufactured goods abroad in ever increasing amounts.

Fifty years ago, when the free trade policy was dominant through the greater part of the world, the task of Germany would not have been so difficult, but at the present time with the exception of England the great powers are committed to a policy of protection. France and the United States are almost closed countries to German manufactures. The course of trade between the United States and Germany during the past ten years is significant. In 1892, the United States imported $83,000,000 worth of German goods and exported to Germany $105,000,000 of goods. In 1901, the imports from Germany amounted to $100,000,000 and the exports were valued at $192,000,000,—an increase in imports of 26 per cent. and in exports of 92 per cent. Russia is rapidly developing her manufacturing industries and while for a time she must buy more or less of foreign manufactures her economic independence will not be long delayed. In England also there is more or less discussion of a zollverein with the colonies. Excluded from the greatest natural markets for manufactured goods, Germany must struggle for the smaller markets against the keen competition of both England and the United States.

The need of Germany for foreign markets is far greater than that of Russia or the United States. In the latter countries a check to foreign trade means only a readjustment of the industrial population. The same is true of England and her colonies. A serious check to the sale of her manufactured goods means to Germany the emigration of her people and the loss of political prestige.

THE ECONOMIC EVOLUTION OF PORTO RICO.

By F. del Valle.

[Abstract of a paper read before the Economic Seminary, March 25, 1902.]

The study of the economic evolution of Porto Rico extends over the three natural divisions of the island's history, i. e., the Indian period, the Spanish period, and the American period. The Indian period does not differ from that of other savage peoples; Porto Rican Indians had reached only the neolithic period of the stone age.

Spain adopted and applied to Porto Rico the colonial policy of monopoly from the beginning of her settlement in the Island. The foundation of the Council of Seville marks the starting point of a mercantile traffic with the new colonies, characterized by confinement of business transactions to a particular port (Seville); restrictions in national navigation and prohibition of trade with foreign nations. Gradually other, and later all the ports of the Peninsula and the Indies were opened to commerce, while eventually the Island was opened to universal commerce.

The early stages of this development were attended by a long depression that began with the exhaustion of the island's mines. When agriculture attracted the attention of the colonists, they found prohibitions, obstacles and imports which discouraged all agricultural enterprise. Under these unfortunate conditions the country progressed so little, that nearly three centuries after its discovery Count O'Reylly, special commissioner from the government, visited the colony and reported that its inhabitants were the poorest in America.

In 1778 the wise and liberal policy advised by Florida Blanca, Aranda and Jovellanos during the reign of Charles III, was followed and free commerce was proclaimed. Porto Rico as other, Spanish colonies felt the good effects of the ordinance; but what caused a total transformation of the Island was the opening of all the Spanish ports of America to universal commerce obtained in 1816 by D. Alejandro Ramirez, the first Intendant of Porto Rico, and later applied to all the colonies. Ramirez also organized the financial system, redeemed the paper money and encouraged the study of political and social economy in Porto Rico.

During the American period, Porto Rico has experienced a crisis due to many complex causes. Once more the influence of economic science has been beneficial to the Island. The work of Dr. J. H. Hollander as the first American treasurer of Porto Rico, like the work of Intendant Ramirez was a work of financial reconstruction. The Hollander Bill converted the Island into a self-supporting community and permitted the early operation of free trade.

The influence of the treasurers or Intendants of Porto Rico upon its development has always been acknowledged by the people of the Island. Men versed in economic science have effected every favorable change in its economical and financial history.

An analysis of the products of the Island shows that ginger and cattle were originally principal products; that tobacco was the first production exported; that cotton disappeared from the list of Porto Rican exports after 1864; that coffee has steadily increased and sugar has been subjected to many oscillations. The present condition of the Island is encouraging and it is expected that its three principal products, coffee, sugar and tobacco, will find large room in the markets of the United States, and that other natural products of its soil, such as fruit, will receive a great impulse in the future.

TAXATION IN JAPAN.

By KENKICHI KODERA.

[Abstract of a paper read before the Economic Seminary, April 13, 1902.]

The forms of direct taxation in Japan are the land tax, the income tax, and the business tax; the forms of indirect taxation are the tax on Sake, the tax on Soy, and the custom duties.

The land tax is imposed according to the legal value of land. The rate of tax differs according to location: 5 per cent. of the legal value is levied on city-lots, while 3.3 per cent. is levied on other lands. The payer of the land tax is the owner, as recorded in the Land Record Office, or the mortgagee.

The income tax is imposed upon the annual personal and property income of every person or juristic person, having civil or commercial domicile within the territorial jurisdiction of Japan. It is divided into three classes: (1) income tax on juristic persons; (2) income tax on interest from public lands and from debentures of juristic persons; (3) income tax on individuals. The rate of the tax differs according to the classes, being 2.5 per cent. upon the incomes of juristic persons and 2 per cent. upon the income of the second class. The tax on individuals increases with the amount of income; thus for example, an income of 300 yen pays 1 per cent. while an income of 100,000 yen pays 5.5 per cent.

The business tax is imposed upon all persons or juristic persons engaged in lawful business. It is levied upon the basis of receipts from goods sold, amount of capital, rental value of buildings, amounts of commissions, number of employees, etc.

The tax on Sake is imposed upon Sake manufacturers according to the amount produced. It is divided into two classes: (1) Sake (2) alcohol. The rate of the tax is 12 yen per Koku upon Sake, and 13 yen per Koku upon alcohol. The tax on Soy is similarly imposed upon Soy manufacturers at the rate of 2 yen per Koku.

The custom duties are imposed upon articles imported into Japan. According to the present tariff regulations, articles are divided into three classes: (1) articles subject to duty; (2) articles exempted from duty; (3) prohibited articles. The rates of duty for the first class of articles are fixed between the minimum of 5 per cent., and the maximum of 40 per cent., and the average rate is 10.52 per cent.

The total receipts from taxation for the fiscal year 1900–1 were 136,000,000 yen, of which the land tax amounted to 47,000,000 yen, the income tax 5,000,000 yen, the business tax 5,000,000 yen, the tax on Sake 55,000,000 yen, the tax on Soy 3,000,000 yen, the custom duties 15,000,000 yen, and the other inland taxes 3,000,000 yen.

JAPAN'S FOREIGN TRADE SINCE THE RESTORATION (1868-1900).

By YUKIMASA HATTORI.

[Abstract of a paper read before the Economic Seminary, April 22, 1902.]

The total amount of Japan's exports and imports was 26 million yen in 1868; 65 million yen in 1880; 138 million yen in 1890, and from that year on, the aggregate increased by leaps and bounds—most notably after the China-Japanese War (1894–5)—until it reached the enormous sum of 491 million yen in 1900. Stated in terms of the yen, this increase is, however, more apparent than real. Since 1873 the value of silver not only relative to gold but also relative to all commodities has gradually gone down, or in other words general prices in Japan have gone up about seventy-five per cent. so that the figures above stated must be reduced according to the index number of prices in each, particular year in order to show the actual quantity of commodities.

In character, it is only since 1890 that Japan's export trade has undergone important change. Such commodities as cotton yarn, *habutaye* (white silk fabric,) silk handkerchiefs, matches, straw braids, floor matting, and European umbrellas, which now form the most important exports, first appeared in the foreign trade of Japan almost simultaneously in 1890. For example, in the case of cotton yarn and *habutaye*,—in 1890 the export of the former was only 2,000 yen and of the latter 818,000 yen; in 1900 the corresponding figures were 20,589,000 yen and 18,314,000 yen, respectively. In other words, up to 1890, the principal articles of export were the natural products most suited to the soil of Japan such as tea, raw silk, rice, copper, coal, camphor and marine products. Since 1890, the export of manufactured goods has gradually risen to a far larger percentage than that of raw materials.

The logical consequence of this change in the character of Japan's foreign trade has been a change in its geographical distribution. The tide of Japanese trade is moving more and more towards the eastern shores of continental Asia, namely, Russian Asia, Corea, China, Hongkong, British India and the Straits Settlement. Both exports to and imports from European countries are decreasing, relatively; while the imports from the United States show a remarkable increase.

THE SOUTH CAROLINA DISPENSARY SYSTEM.

By Porter Hollis.

[Abstract of a paper read before the Economic Seminary, May 6, 1902.]

The South Carolina liquor system, known as the Dispensary, is the outgrowth of a prohibition sentiment, culminating in the Democratic primaries of 1892 when 38,890 votes were cast in favor of prohibition as against 24,464 votes for non-prohibition. When the question came up in the General Assembly, a majority of the members claiming that the enforcement of prohibition was impracticable, passed the dispensary law instead.

The law provides that all liquors sold in the State must be "dispensed" by State officers. There is a State Dispensary in charge of a board of directors. These directors elect a commissioner, who is the executive officer of the State institution. All liquor bought under the system is first shipped to the State Dispensary at Columbia and from there distributed to local dispensaries throughout the State. A local dispensary can be established in a township only after a majority of the voters have given their consent. No dispensary can be established in any other than an incorporated town.

The buyer is required to sign a written request for the liquor, stating his age, residence, and the quantity of liquor wanted. No liquor can be sold to minors or to persons known to be habitual drunkards. The local dispenser is a salaried officer and there is no incentive to unlawful sales. Dispensaries must be open only in the day time and must be closed on holidays and Sundays. Liquor is sold in sealed packages and cannot be opened or drunk on the premises. A constabulary force is maintained to suppress illicit traffic.

From the first the system has been more than self-sustaining, although the law was not enacted for revenue purposes. The profits of each local dispensary are divided equally between the county and the municipality where located. The State gets its revenue by fixing a profit not exceeding ten per cent. on all liquors shipped to the county dispensaries. After the operating expenses have been deducted from the State's gross profits the net returns are applied to the public school fund. For the fiscal year 1901 the net profit accruing to the State for account of the school fund was $120,962.25.

There has been much opposition to the law ever since it went into operation. The prohibitionists have been dissatisfied because the law allowed liquor to be sold as a beverage. The former saloon-keepers have fought the law because it destroyed their business. Many of the conservative faction have opposed it for the reason that it is a product of the reform or Tillmanite movement.

Of late years political parties in South Carolina have divided principally on the liquor question. The prohibitionists had a candidate for governor in each of the last two campaigns, but the dispensary side has always won. The law has had a stormy life so far but it seems to be gradually growing in favor and is probably a permanent institution in South Carolina.

A GIFT FOR THE INVESTIGATION OF LABOR ORGANIZATIONS IN THE UNITED STATES.

A citizen of Baltimore, who desires that his name shall not be made public, has given the Johns Hopkins University a sum of money for the purpose of instituting a systematic investigation into the history, activities and influence of labor organizations in the United States. Five hundred dollars is given for the immediate purchase of additions to the University Library in this direction, and the further sum of one thousand dollars is made available for meeting the expenses incident to the inquiry in the academic year 1902–03.

The investigation will be conducted by the Economic Seminary, under the direction of Associate Professor Hollander, assisted by Dr. Barnett. It will begin in October, 1902, and will extend over such period of time as may be warranted by the extent of the inquiry and the definiteness of the results attained. A preliminary organization of the Seminary will be effected before the close of the present academic term; certain preparatory work will be assigned its members for the summer recess and a working plan will be prepared and adopted so that the investigation may proceed promptly thereafter.

The initial task will be the preparation of a complete bibliography relating to the labor question in the United States. The investigation proper will commence with an inquiry into certain of the more concrete aspects of the subject. The immediate environment will first be studied, after which conditions in other typical communities will be examined until sufficient data for reasonably safe generalizations have been obtained. A number of such inquiries will ultimately prepare the way, it is hoped, for a comprehensive survey of the nature and functions of labor organizations in the United States.

A HISTORY OF SLAVERY IN VIRGINIA

BY

JAMES CURTIS BALLAGH, Ph. D.

Associate in History in the Johns Hopkins University.

160 pages. 8o. Cloth. $1.50.

This volume presents the results of an extended investigation of the institutional character of American slavery. Entirely new conclusions are reached as to its origin and development in the English colonies. The relation of slavery as a form of labor and of social dependence to similar forms in Europe and America is shown.

The important position of Virginia as a colony and a State and her influence upon the South make a minute study of the status of her dependent classes of general as well as of local interest. A comprehensive history of the legal and customary treatment of slaves in Virginia to the period of emancipation is here given for the first time.

The work is chiefly based upon contemporary documents and manuscripts, state and county archives, and transcripts from the British Public Record Office. It is well indexed.

The Johns Hopkins Press,
Baltimore, Md.

NOTES FROM THE BIOLOGICAL LABORATORY.

AN ANALYTICAL KEY FOR THE FERNS OF THE NORTHEASTERN STATES, BASED ON THE STIPES.

By C. E. Waters.

This key is in many respects similar to the one published in this *Circular* in 1895, but it has been thoroughly revised and much enlarged. The preceding one was faulty in that it did not take into account any but average-sized specimens of the different species. In the revision very large, as well as very small specimens of each species were studied when possible. It was found that, in most cases, the stalks differed but slightly, and, as a rule, only in the number of bundles.

In selecting a specimen, choose as large a one as possible when the ferns are small. In nearly all cases, the extreme lower part of the stipe is more or less flattened, or distorted, or differs more or less from the upper part. The stipe is to be cut squarely across just above this basal part. The fibrovascular bundles are seen as dots or lines. The ferns are classified primarily, in this key, according to the number of bundles in such a cross-section. In cases of evident asymmetry of arrangement it is well to look under the next higher or next lower section.

In this key the following definitions have been adhered to. The *stipe* is that portion of the stalk which is below the leafy portion or lamina. The *rachis* is the continuation of the stipe, unless the frond be simple, when the term *midrib* is used. The stipe and rachis together are spoken of as the *stalk*. The *front* of a stalk is on the side towards the upper surface of the frond. The opposite side is the *back*. *Above* and *below* mean near the tip and base of the stalk, respectively.

The nomenclature is that adopted by B. D. Gilbert in his "List of North American Pteridophytes" (Utica, 1901), because it is conservative on the whole. Very properly, *Athyrium filix-fœmina* and *A. thelypteroides* are separated from the genus *Asplenium*, while *Nephrodium* and *Polystichum* are given generic rank in place of *Aspidium* or *Dryopteris*.

The key is designed solely as an aid to identifying the ferns when they cannot be obtained in fruit. Every species that could be obtained in a fresh condition is here described.

A. ONE BUNDLE.

I. Bundle decidedly curved.

* Bundle more or less rolled up or folded at the ends.

1.—*Osmunda cinnamomea*, L. and var. *glandulosa* C. E. Waters. Stalk green, often reddish below in large specimens. Rachis and upper part of stipe narrowly 2-winged or ridged. Small stipes often have traces of grooves in front. Bipinnatifid. Pinnæ deciduous, with a tuft of wool at the base of each. The variety has the stalk and pinnæ more or less glandular-pubescent. 3–5 feet. Swamps, etc.

2.—*Osmunda Claytoniana*, L. Much like No. 1, but the entire stipe is 2-ridged. Large stalks have traces of grooves in front. Bipinnatifid. Pinnæ deciduous, without wool tufts. 2–4 feet. Low grounds.

3.—*Osmunda regalis*, L. Stalks dark, rather hard. Rachis 2-winged above. Bipinnate. No wool at base of pinnæ. 2–5 feet. Swamps, etc.

4.—*Adiantum pedatum*, L. Stalks very dark brown, polished, wiry; slightly grooved in front, below. Fronds dichotomously forked, or ternate in small specimens. 9–15 inches. Rich woods.

* * Bundle not rolled up at the ends.

5.—*Botrychium ternatum* (Thunb.) Swz. and *var.* Stalks very soft, reddish. Divisions of rachis and upper part of stipe grooved in front. Bundle almost, or quite curved into a ring below; above, dividing into 2–4. Ternate. Bipinnate to tripinnatifid. 4–16 inches. Wet thickets, etc.

6.—*Pellæa gracilis* (Michx.) Hook. Stipe brown, slender. Rachis green (or brownish below). Stalk deeply grooved in front. Stipe laterally grooved. Grooves less distinct below. In small stipes the bundle is a mere dot. At times the bundle is barely curved. Small, very delicate. Bi-tripinnatifid. Shaded rocks.

7.—*Pellæa atropurpurea* (L.) Link. Stalk very dark brown, wiry, brittle; shining but roughish, and having light brown or whitish pubescence; no grooves or ridges. 1–2-pinnate, coriaceous. 6–18 inches. Rocks (usually calcareous).

8.—*Dicksonia pilosiuscula* Willd. Stalk green or yellowish, except towards the brown base; glandular-pubescent throughout; grooved in front to base, and on sides nearly to base; shining but roughened by minute projections. Tripinnatifid. 2–3 feet. Moist, shady places.

Small specimens of Nos. 28 to 39, may fall under this section.

II. Bundle V or X-shaped.

Small specimens of Nos. 13 to 25, 40, or sections taken too far above the base may fall under this heading.

III. Bundle oval or round.

9.—*Asplenium Trichomanes* L. Stalk very dark brown, polished. Rachis and nearly the entire stipe ridged on the sides, flattened in front. Pinnate, with roundish-oblong or oval, deciduous pinnæ. 3–8 inches. Rocks.

10.—*Asplenium viride* Hudson. Stalk reddish-brown at base, green above; somewhat flattened in front, below; above, deeply grooved. Stipe somewhat flattened laterally, and with traces of grooves that become more marked in the rachis. Pinnate, with roundish-ovate or ovate-rhomboid pinnæ. 2–6 inches. Rocks.

11.—*Schizæa pusilla* Pursh. Stalk very slender, green (brownish when old), grooved in front, (except in very small specimens), to the brown base where it is more slender and flattened. Two very slight grooves at the back are marked by two dotted lines. 3–4 inches, or sterile fronds much smaller and linear. Pine barrens of New Jersey.

12.—*Lygodium palmatum* (Bernh.) Swz. Stalk light brown or yellowish, except at base; slender, twining, slightly flattened in front. The short, alternate branches 2-forked, each fork with a round-cordate, palmately cleft pinnule (4–7-lobed). 1–3 feet. Moist thickets.

See also Nos. 6, 41, 42.

B. TWO BUNDLES.

I. Bundles nearly joined in a ring.

See Nos. 5, 46 to 50.

II. Bundles round or oval at extreme base, soon flattening and approximating to form a V or X.

13.—*Asplenium pinnatifidum* Nutt. Lower half or two-thirds of stipe brown and shining, green above. Rachis and upper part of stipe broadly winged. Stipe flattened in front, below; higher up, with a broad groove; flattened, and with traces of grooves on sides. Pinnatifid (or pinnate below), with a slender prolongation. Veins rarely areolate. 3–6 inches. Rocks.

14.—*Asplenium Ruta-muraria* L. Stalk green, except at extreme base; deeply grooved in front to extreme base, with slight lateral grooves (or none in very small specimens), 2–3-pinnate at base. 2–5 inches. Texture almost coriaceous. Rocks.

15.—*Asplenium montanum* Willd. Stipe brown at base, green above. Rachis and upper two-thirds of stipe flat, with two parallel grooves in front. Pinnate, with deeply cleft pinnæ; coriaceous. 2–6 inches. Rocks.

16.—*Asplenium Bradleyi* D. C. Eaton. Stipe and lower part of rachis brown. Stalk grooved in front, except toward flattened base, with a slight ridge down the center of groove. Bipinnatifid. 4–9 inches. Rocks.

17.—*Asplenium parvulum* Mart. and Gal. Stalk black, shining, flattened in front, below. Stipe very short, with two ridges that run into the pale brown ridges, or narrow wings, of the rachis. Pinnate, with auricled, oblong, thickish pinnæ. 4–10 inches. Rocky soil.

18.—*Asplenium ebeneum* Aiton. Stalk dark brown, polished, stipe very short, not flattened, grooved, or ridged. Rachis grooved in front, and with two lateral ridges (except near base) from which the pinnæ spring. Pinnate, with oblong or oblong-linear pinnæ. 9–18 inches. Rocky soil.

19.—*Asplenium ebenoides* R. R. Scott. Stipe and lower part of rachis dark brown, polished. The green wings of the rachis run into two lateral ridges in the upper part of stipe which thus appears 2-grooved in front. Pinnatifid, (or pinnate below), with a long, slender prolongation. Veins often areolate above. 4–9 inches. Rocks.

20.—*Camptosorus rhizophyllus* (L.) Link. Stipe brown at base, green above, flattened on three sides; slightly grooved laterally, and 2-grooved in front, above. Simple, entire, usually with a slender prolongation. 4–12 inches. Veins areolate. Rocks.

21.—*Cheilanthes vestita* Swz. Stalk brown, shining, but thickly clothed with 1–6-celled hairs (which appear jointed under a lens); articulated to rhizome; not grooved or ridged. Two bundles rarely seen. Tripinnatifid, clothed with jointed hairs. 6–15 inches. Rocks.

22.—*Woodsia glabella* R. Br. Stipe articulated above base, with a few pale scales below joint, smooth above. Stalk green or yellowish except at extreme base, smooth, grooved in front nearly to base. Pinnate, with lobed pinnæ. 2–5 inches. Rocks.

23.—*Woodsia hyperborea* R. Br. Stipe articulated above base. Stalk more or less hairy, black at base; brown, shading to yellowish above. Pinnate, with pinnatifid pinnæ. 2–6 inches. Rocks.

24.—*Woodsia Ilvensis* (L.) R. Br. Stipe articulated above base. Stipe and under side of rachis scaly. Stalk flattened and grooved in front to the joint or below; brown below, shading to green, above. Pinnate, with pinnatifid, chaffy pinnæ. 2–8 inches. Rocks.

25.—*Woodsia obtusa* (Spreng.) Torr. Stipe not articulated. Stalk brown at base, green or yellowish, above, with pale scales and glandular pubescence. Rachis and upper part of stipe grooved in front and often with traces of lateral grooves. Stalk usually marked with two green lines. Nearly bipinnate. 6–15 inches. Rocky banks and cliffs.

III. Bundles roundish, not soon uniting into a V or X.

26.—*Phyopteris Dryopteris* (L.) Fée. Stipe slender, translucent, smooth except at dark brown base. Black tissue surrounding bundles is very evident through the stalk. Stipe slightly flattened below, grooved in front, above. Ternate rachis deeply grooved in front. Ternate, with 1–2-pinnate divisions. 3–8 inches. Rich woods.

27.—*Cystopteris fragilis* (L.) Bernh. Stalk slender, weak, brown below, green above, smooth; with lateral grooves (often absent in small specimens); grooved in front, except at the flattened base. Bi-tripinnate. Very variable. 8–15 inches. Cliffs and rocky woods.

28.—*Woodwardia angustifolia* Sm. Stipe dark brown and tapering at base green or stramineous above, with scattering brown scales; flattened, (and rarely with traces of grooves) in front; laterally ridged. Pinnatifid; scaly beneath along midribs; veins areolate. 10–18 inches. Wet woods near coast.

See also Nos. 41, 42 (small specimens).

IV. Bundles oval or flat (curved in No. 40).

* Bundles usually 1½ to 2½ times as long as broad.[1]

29.—*Nephrodium Noveboracense* (L.) Desv. Stalk grooved in front, slender. Rachis flattened on sides, with slight grooves. Stipe less flattened and with traces of grooves. Bundles about 2 x 1, bridged.[2] Pinnate, with pubescent, pinnatifid pinnæ, the lower pairs much reduced. Stalk pubescent. Veins simple. 12–24 inches. Moist woods, etc.

30.—*Nephrodium simulatum* Dav. Stalk weak, pubescent. Rachis distinctly 3-grooved. Stipe similarly grooved above; the lateral grooves extend to the dark base; lower half, or less, flattened, and with traces of two grooves in front. Pinnate, with pubescent, pinnatifid pinnæ, the lowest scarcely reduced. Veins simple. Bundles 2 x 1, bridged. 8–20 inches. Wet thickets.

31.—*Nephrodium thelypteris* (L.) Desv. Stalk 3-grooved, except at base where it is flattened on three sides; pubescent. Bundles not bridged, 1⅓ x 1. Veins forked. Pinnate, with nearly smooth, pinnatifid pinnæ, the lowest scarcely reduced. 12–24 inches. Swamps.

32.—*Cystopteris bulbifera* (L.) Bernh. Stalk weak, translucent, pale-green (often pinkish) shading to brown, below. Rachis and upper part of stipe grooved in front, flattened and with traces of grooves on sides. Stipe flat in front, below. Bundles about 2 x 1, not bridged. Bi-tripinnate. Rachis and midribs often bulbiferous beneath. 12–24 inches. Ravines.

33.—*Phegopteris hexagonoptera* (Michx.) Fée. Stipe slightly flattened in front, and with a light-green line on each side (except in forms approaching No. 33); often with traces of front and lateral grooves. Fronds triangular, about as broad as long; bipinnatifid, pubescent, often with scales along the midribs beneath (as in No. 33). Bundles uniting rather soon, bridged. 7–20 inches. Open woods.

34.—*Phegopteris polypodioides* Fée. Stipe usually rather dark above, pubescent, flattened in front, and usually grooved. Fronds triangular, longer than broad, bipinnatifid, pubescent, with scales along the midribs beneath. 8–15 inches. Damp woods.

* * Bundles usually more than 2½ times as long as broad.

35.—*Asplenium angustifolium* Michx. Stalk green with brown pubescence; black at extreme base where there is a dense sheath of hairs; deeply grooved in front. Rachis flattened laterally above, grooved below. Stipe grooved in front, except at 2-ridged base. Rachis narrowly 2-winged near top. Pinnate, with thin, linear-lanceolate pinnae. 1–3 feet. Rich woods.

36.—*Athyrium filix-fœmina* (L.) Roth. Stalk green or reddish, smoothish, 3-grooved nearly to base where there are a few tooth-like projections on the lateral ridges. Bundles bridged. Bipinnate, with more or less incised pinnules. Very variable. 1–3 feet. Moist woods.

37.—*Athyrium thelypteroides* (Michx.) Desv. Stalk green, pubescent; grooved in front and slightly on sides, except the lower half of the stipe. Stipe with tooth-like projections on the lateral ridges at the extreme base. Bundles bridged. Bipinnatifid. 1½–4 feet. Rich, moist woods.

38.—*Onoclea sensibilis* L. Stalk yellowish (often pinkish at base), smooth, triangular in large specimens, with traces of grooves in front and on sides, above; 2-ridged below on sides; above, with two light lines that run into the broad wings of the rachis. Broadly triangular, deeply pinnatifid. Veins areolate. 1–2½ feet. Wet thickets, etc.

39.—*Struthiopteris Germanica* Willd. Stalk dark-green, deeply grooved in front, much flattened and with traces of grooves on sides. Rachis very narrowly winged on each side of the front groove, so that it has apparently three grooves in front and two on each side. Some stipes have tooth-like projections at the rhombic base. Bundles bridged. Bipinnatifid, with lower pinnæ much reduced. 2–6 feet. Alluvial soil.

40.—*Scolopendrium vulgare* J. Sm. Stipe scaly, somewhat flattened on three sides and 2 ridged above; traces of grooves in front near the middle. Bundles very much curved and finally forming an X. Simple, oblong-lanceolate with cordate base; scaly along midrid, beneath. Ravines.

C. THREE BUNDLES.

I. Bundles curved, arranged in a ring.

See Nos. 5, 46–50.

II. Bundles round or oval.

41.—*Polypodium incanum* Swz. Stalk and under side of pinnæ covered with peltate scales with dark centers, and ovate, laciniate scales

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[1] Written 1½ x 1 and 2½ x 1 in the descriptions.

[2] In section IV some of the bundles coalesce at a distance above the base and form a curved bundle. In others they become united by a straight connective joining one end of each. We shall call the latter "bridged" bundles.

(especially on the front of stipe). Stipe articulated to rhizome; 2-ridged in front. Bundles three at extreme base, soon becoming two, and then one. Pinnatifid. 2–6 inches. Rocks, trees, etc.

42.—*Polypodium vulgare* L. Stalk green, smooth or nearly so; 2-ridged so that the front often seems 2-grooved; articulated to rhizome. Bundles soon uniting as in No. 40. Pinnate or nearly so, fronds smooth. 4–10 inches. Rocks.

43.—*Nephrodium fragrans* L. Stalk yellowish-green, scaly and glandular-pubescent. Rachis and upper part of stipe grooved in front. Bundle at back of stipe slightly smaller than the other two. Bipinnatifid; glandular. 4–12 inches. Rocks. Large specimens may fall under **E.**

44.—*Ophioglossum vulgatum* L. Stipe green, soft and spongy, grooved in front above. Bundles 3–6, obscure, arranged around the irregular spongy center. Simple, ovate to elliptic. Veins areolate. 2–10 inches. Bogs and pastures.

Small specimens of all the species belonging properly under **E** may occur here.

D. FOUR BUNDLES.

I. BUNDLES ROUND OR OVAL.

45.—*Polystichum Braunii* (Spenner) Lawson. Stalk densely clothed with large scales and hairs. Stipe very short, flat in front; marked with curved scars when the scales are rubbed off; above, with traces of lateral grooves that run into two ridges below. Rachis grooved in front, flat on sides. Bipinnate, with chaffy pinnæ, the lower ones reduced. Bundles four near base, often five above. 1–2 feet. Deep woods.

Small specimens belonging properly under **E** may occur here. See also No. 44.

II. BUNDLES CURVED AND ARRANGED IN A RING.

* Bud completely enclosed in base of stipe.

46.—*Botrychium lanceolatum* (S. G. Gmel.) Angs. Stalk soft, whitish below, shading to pinkish (or brownish) and then green, above; spongy. Two lateral ridges and a slight groove extend a short distance below the base of the sterile segment. Two bundles at base, two to six (usually four) a short distance above. Fleshy; triangular, ternately bipinnatifid; midvein continuous, lobes acute. 3–10 inches. Woods. Leaf bent over recurved fertile segment in bud (Davenport).

47.—*Botrychium matricariæfolium* A. Br. Stalk and bundles as in No. 46. Sterile segment ovate or triangular, pinnate to bipinnatifid. Lobes obtuse; midveins dissipated by branching. 3–10 inches. Woods. Apices of leaf and fertile segment turned downward in bud (Davenport).

48.—*Botrychium simplex* Hitchcock. Probably belongs here. Sterile segment near base of stem; ovate, obovate, oblong, entire, lobed, or pinnatifid. 2–5 inches. Woods. Apices of both segments erect in the bud (Davenport).

49.—*Botrychium Lunaria* (L.) Swz. Probably belongs here. Sterile segment very fleshy; pinnate with lunate or fan-shaped, crenate, incised, or nearly entire divisions. 4–10 inches. Pastures. Apex of leaf bent over straight fertile segment in the bud (Davenport).

* * Bud cavity at base of stipe open at one side.

50.—*Botrychium Virginianum* (L.) Swz. Stalk fleshy, pinkish. Divisions of rachis with wings that run into two ridges on the stipe just below the sterile segment. Ternate, with primary divisions 1-2-pinnate, and then 1-2-pinnatifid. 6–24 inches. Rich woods. Bud pilose. Bundles as in No. 46.

See also No. 5.

E. FIVE BUNDLES.

I. MIDDLE BUNDLE NO LARGER THAN THE TWO ADJACENT ONES.

See Nos. 43, 44, 45.

51.—*Polystichum acrostichoides* (Michx.) Schott. Stalk brown at base, green above; more or less chaffy. Rachis and upper part of stipe slightly grooved in front; sometimes with traces of lateral grooves in large specimens. Lower part of stipe slightly flattened in front and with slight ridges (or only light lines) on sides. Pinnate, with thickish, auricled pinnæ. 1–2½ feet. Rocky woods.

II. MIDDLE BUNDLE LARGER THAN ADJACENT ONES.

52.—*Nephrodium spinulosum* (Retz.) Desv. and *var.* Stalk with scattered scales; 3-grooved to base, where it is slightly ridged on sides. Bipinnate to tripinnatifid; ovate-lanceolate or ovate to triangular-ovate. 1–2½ feet. Damp woods, etc.

53.—*Nephrodium Boottii* (Tuckerman) Dav. Stalk with scattered scales; grooved in front, and slightly on sides nearly to base. Extreme base ridged on sides and grooved in front. Bipinnate to tripinnatifid, elongated lanceolate, narrowed at base. 1–2½ feet. Wet thickets. Intermediate between Nos. 52 and 54.

54.—*Nephrodium cristatum* (L.) Michx. Stalk with scattered scales; 3-grooved nearly to base where it is ridged on sides. The front groove becomes obscure towards the base. Linear-oblong or lanceolate, bipinnatifid; texture thick. 1–3 feet. Wet thickets.

55.—*Nephrodium cristatum X marginale* Dav. Grooves, etc., as in No. 54. Rootstock with crown central as in No. 56 (not growing beyond the fronds as in No. 54.) Upper two-thirds of frond like No. 56, being broader, and having the pinnæ and apex more acuminate. Bipinnatifid. 1–2½ feet. Swamps.

56.—*Nephrodium marginale* (L.) Michx. Stalk densely scaly below; grooved in front to base, and on sides. The lateral grooves run into two slight ridges at the extreme base. Bipinnate, coriaceous. Ovate-oblong with lanceolate pinnæ. Pinnules entire or crenate, oblong. 1–2½ feet. Rocky woods.

Small specimens of Nos. 57 and 58 may occur here. See also Nos. 44, 46 to 50.

F. MORE THAN FIVE BUNDLES.

I. BUNDLES REGULARLY ARRANGED.

Large specimens of Nos. 44, 46 to 56, may occur here.

57.—*Nephrodium Goldieanum* Hooker. Stalk with linear scales, and very large, dark brown, lanceolate ones with paler margins. Rachis and upper part of stipe grooved in front, and with two light green lateral lines that run into slight ridges at the base. Bundles usually seven, roundish. Bipinnatifid. Pinnæ broadest in middle. 2–4 feet. Rich woods.

58.—*Woodwardia Virginica* (L.) Sm. Stipe and lower part of rachis brown. Stalk grooved in front to base, and with two lateral lines running nearly to base. Rachis with a slight ridge below the base of each pinna; 5-grooved above, below 3-grooved, as is the upper part of stipe. Bundles usually 7 to 9. Central tissue of lower part of stipe usually dark-brown and spongy. Bipinnatifid. Veins forming a single row of areoles along the midribs of pinnæ and lobes. 2–4 feet. Swamps.

II. BUNDLES IRREGULARLY ARRANGED.

59.—*Pteris aquilina* L. Stalk brownish, with a dense sheath of hairs below ground, just above rhizome. Stipe flattened, and with one or two grooves in front. Rachis and secondary rachises 3-grooved. Stems with light lines along sides. Bundles curved, flat, or oval, rather irregularly arranged. Ternate with bipinnate branches. 1–4 feet. Thickets, etc., usually in sandy soil.

THE DEVELOPMENT OF THE EMBRYO-SAC IN PIPER AND HECKERIA.

By DUNCAN S. JOHNSON.

The writer has been able to follow the development of the embryo-sac in two species of Piper and two of Heckeria. No considerable differences were discovered, therefore a description of the development of the embryo-sac of *Piper medium* will serve to indicate the differences between these genera and the several species of Peperomia thus far studied.

In *Piper medium*, at a time when the integuments are just appearing, an axial hypodermal cell cuts off a tapetal cell above, which divides to form five or six tiers of cells above the embryo in the ripe seed. The lower half of the hypodermal cell becomes directly the functional megaspore, without further division. This megaspore swells laterally and elongates to twice its width. The nucleus then divides and each daughter nucleus takes a polar position and soon divides. The four nuclei thus formed are frequently found grouped near the middle of the embryo-sac. The eight nuclei resulting from the next division soon arrange themselves in the manner found in most Angiosperms. The large egg and two synergids occupy the broad upper end of the embryo-sac, the polar nuclei fuse near the middle (probably before fertilization) and the three well marked antipodals lie in a pit at the base of the sac.

The endosperm nucleus divides many times without the formation of cell walls, giving rise thus to a typical multinucleate lining of protoplasm in the embryo-sac. When about a hundred nuclei have been formed, and the oospore is still undivided, cell walls appear throughout the endosperm. The ripe seed contains an undifferentiated embryo of some hundreds of cells, surrounded by from five to eight cell-layers of endosperm, the whole occupying about .003 of the bulk of the seed.

The whole course of development is thus like that of typical Angiosperms, and does not show any features which might serve as evidence that the sixteen-nucleate embryo-sac of the closely related genus Peperomia is a more primitive type.

THE GERMINATION OF THE SEED OF PEPEROMIA AND CERTAIN OTHER GENERA.

By Duncan S. Johnson.

[An abstract.]

I have been able to follow out the fate of the various structures in the seed during germination, in seeds of *Peperomia pellucida* brought from Jamaica by Mr. W. C. Coker in August, 1900.

The ripe seed is .5 mm. long, the globular fifteen-celled embryo .04 mm. and the surrounding endosperm .1 mm. in diameter. The remaining, and by far the greater bulk of the seed is made up of the perisperm richly stored with starch. The first change noticeable in the germinating seed is the increase in size of the embryo. This reaches .1 mm. in diameter and the surrounding endosperm .25 mm. in diameter before the seed coat is burst. When this latter occurs the endosperm pushes out but continues to surround the embryo entirely until the latter is .5 mm. long and the radicle and cotyledons are well formed. The radicle and later the bases of the two cotyledons push out through the sac of endosperm. The latter remains as a cap tightly covering the tips of the cotyledons and itself surrounded by the perisperm of the seed. The root curves down to anchor in the soil and the hypocotyl stretches to raise the seed, still clinging to the tips of the cotyledons till all of the food is absorbed.

The endosperm is never more than one or two layers thick and never contains any appreciable amount of starch. In the ripe seed it is full of aleurone granules which gradually disappear as germination progresses, though the endosperm cell walls remain intact. Simultaneously with the decrease of this proteid material from the endosperm the starch in the perisperm disappears, from the endosperm outward, leaving the cell walls intact till crushed in by the swelling endosperm. The inference drawn from these facts is that the function of the endosperm here is to digest the starch stored in the perisperm, by the aid probably of a ferment prepared from the proteid granules, and then to absorb and pass on the digested material to the embryo.

The type of germination described here has been noted in Saururus only, so far as I am aware, but is probably the common mode in seeds possessing perisperm. In another of the Piperaceae, *Heckeria umbellata*, the process of germination is almost identical with that found in Peperomia. In the monocotyledonous genus Canna the single layer of endosperm of the ripe seed persists about the haustorium, at least till an advanced stage of germination. In Dianthus and Cerastium of the Caryophyllaceae, in Phytolacca and in Polygonum the embryo is well differentiated and occupies nearly half of the ripe seed. The endosperm in all is of a single layer about most of the embryo, but forms a thicker mass about the radicle near the micropyle. In germination this mass of endosperm aids in bursting the seed coat, and after the radicle has pushed through it, continues as a collar tightly enclosing the cotyledons, effectually preventing the escape of material from the seed and the entrance of anything from without, a protective device evidently of no little importance to the young seedling. The thin layer of endosperm about the cotyledons of the seedling apparently serves the same purpose as in Peperomia.

I have yet to find a case in which the embryo is not surrounded by endosperm until, during either the development or germination of the seed, all of the nucellar tissue is absorbed. I am inclined to believe that the sporophyte of the second generation is nourished by that of the first generation always through the intermediate gametophyte.

NOTES ON THE DEVELOPMENT OF HAMAMELIS VIRGINIANA L.

By D. N. Shoemaker.

Hamamelis is one of the considerable number of genera found only in eastern Asia and eastern North America. The genus includes three species, growing in China, in Japan, and in North America from Nova Scotia to Florida, and west to the Mississippi river. The American form is one of the very few Angiosperms which flower in autumn and mature seed the following year. The material worked on was collected at Baltimore, in Virginia, in Long Island, and in Ohio.

The flower buds appear about the first of June. The flowers occur in clusters of from two to four, usually three flowers in each cluster. In each individual flower there first appears three bracts, then four sepals in two pairs, then four petals in one cycle. The next to appear are two successive cycles of rudiments, the outer of which become stamens, and the inner nectaries. The carpels arise on the now concave torus as two horseshoe-shaped ridges, which coalesce below, thus making a compound ovary with separate styles and stigmas. The bases of the carpels, and the outside of the sepals and bracts are covered by a dense coat of tufted hairs, as are also the buds and young twigs of the plant. The development of the flower is essentially as described by Baillon (Nouvelles notes sur les Hamamélidées. Adansonia, X, p. 120, 1871–1873), except that I have found but a single instance of the occurrence of two ovules in a carpel. The single ovule is borne on the edge of the carpel and is suspended in the cavity. At the time of flowering the ovule is still small, the integuments have only begun growth, and the nucellus does not yet show the definitive macrospore.

The rudiments of the stamens appear early in June, and there is at no time any evidence of more than two microsporangia in each rudiment, one to each mature anther lobe. The pollen sac is opened by a door-like valve, fastened on the side next the carpel.

The edges of each carpel fold in and finally grow together. The tissue at the bottom of the groove thus formed, including the epidermis and one or two subepidermal layers, shows by its thickened walls and deeply staining contents that it possesses stigmatic characters. This conductive tissue leads down to the base of the funiculus, where a small area of the epidermis becomes pappilose.

The pollen grains sprout readily in a gelatinized sixteen per cent. sugar solution, and thus grown they show a marked tendency to form cellulose plugs. They show great resistance to low temperature. Pollen taken from buds which opened in January after a week of cold weather with the mercury as low as —15° Fahr., sprouted quite normal though short tubes. Pollen on first sprouting on the stigma grows with comparative rapidity until the beginning of winter. Thus far the tube is of about the uniform diameter of twelve microns. The upper unprotected part of the carpel soon dies, and the live pollen tube is found during January and February down in the part of the carpel which is covered with hairs. The ovary at this stage is further protected by the inversion of the flower so that the persistent sepals shed off the rain. Pollen tubes thus formed are usually of about twice the diameter and have thicker walls than in earlier stages. When they resume growth in the spring they take on a narrow form of growth again.

By this time by the growth of the ovules they are completely anatropous, and by a twisting of the funiculus of each they face in opposite directions. The epidermis of the whole base of the funiculus now becomes pappilose and the small space between this epidermis and the ovary wall is filled with mucous through which the pollen tube is conducted to the micropyle. Fertilization takes place about the middle of May, or from five to seven months after pollination.

The mature embryo sac is typical. After fertilization the endosperm nucleus divides, and the endosperm thus formed has acquired cell walls by the time there are twelve nuclei formed. These walls are formed first at the bottom of the sac. The endosperm uses up all the nucellus except the epidermal layer, which layer is completed by a differentiation of cells across the base of the nucellus, and so comes to surround the endosperm entirely.

The embryo is furnished with a suspensor, and at maturity of the seed has used up about one-third of the endosperm. It is then straight, and has an axial position in the seed.

The Japanese form, *H. arborea*, flowers very early in the spring, a variety, zuccariniana, as early as in February, so that the seasons of the American and Japanese forms almost overlap.

BUDDING IN THE LARVAE OF *GONIONEMA MURBACHII.*

By H. F. Perkins.

Asexual multiplication in the larvæ of jelly-fishes has been known since 1841 when Sars saw and described the formation of buds in a scyphistoma which was regarded as either *Aurelia* or *Cyanea*. Since that time several analogous cases have been made known. The scyphistoma larvae of *Cassiopea xamachana*, for example, were found producing buds in large numbers. In his monograph on this Rhizostome[1] Bigelow gives a detailed account of the method of budding, and also reviews the literature on similar phenomena in other members of the group. In general it may be said that an important method of propagation in several genera of Discomedusae is gemmation, i. e., the production of buds upon the scyphistoma larvae, the buds developing after detachment, into a second generation of scyphistomas. Buds may arise on stolons from the base of the scyphistoma, as in *Aurelia*, or directly upon its body, and either singly or several at a time. In *Cotylorhiza* the buds develop so rapidly and remain attached so long that large clusters accumulate about the parent scyphistoma. In *Aurelia* and *Cyanea* the distal end of the bud is destined to give rise to the mouth and tentacles, whereas in most other forms the attached or proximal end becomes the oral pole of the larvæ.

In *no other* class of the Hydrozoa is any instance recorded, so far as I can find, of the occurrence of non-sexual multiplication in a form at all analogous to that above mentioned for certain members of the Discomedusae. The purpose of this paper is to describe a phenomenon which has been observed in a Hydromedusa, which presents a striking similarity to the budding in *Cassiopea*. This process was followed in *Gonionema Murbachii*, which belongs to the order Trachomedusae.

It was in the course of a general study of the embryology of this medusa that I came upon the budding larvæ. From eggs obtained at Wood's Hole in August, 1901, a large number of polyps, most of them with four tentacles, were kept alive in the laboratory for several months. During November it was noticed that the number of larvae was increasing, smaller ones making their appearance in parts of the dishes that had been vacant before. Careful observation then showed that some of the larger polyps were apparently budding, knob-like protrusions appearing on the hydrocaulus. These budding individuals were examined frequently, and camera drawings were made of the growing buds. Almost all of the stages in the development of fourteen individuals were noted, and the observations are presented herewith.

When the sexually produced planulae settled down, two or three days after the eggs were deposited, they attached themselves to the bottom of the aquarium, or to slides and watch-glasses laid upon the bottom. At intervals during the first three months of the life of the polyps a slide or watch-glass was removed and immersed in corrosive acetic solution, to kill the larvae which were attached. Amongst a lot killed 23 days after the eggs were laid a polyp was found which exhibited evidences of transverse fission (Fig. 1). The coelenteric pouch had completely divided into two, separated by a partition of endoderm cells which were apparently identical in character with those making up the rest of the stomach walls. A line indicating the fusion of the opposite walls of the original cavity is represented in the figure, between the two pouches. Not forgetting that abnormal forms frequently appear amongst specimens kept alive in the artificial conditions of the laboratory, it is still worth noticing that this individual exhibits a tendency to reproduction by transverse fission. This is a very rare and exceptional phenomenon amongst the Hydrozoa. Kölliker describes a form of spontaneous fissiparous reproduction in *Stomobrachium mirabile* from Messina, and Allman figures a peculiar process in the hydroid *Schizocladium ramosum*;[2] the ends of the ramuli separate off and become free frustules, which settle down and give rise to new colonies. Whether or not this mode of non-sexual multiplication is an important one in *Gonionema* will have to be determined from more abundant material than I have yet secured.

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[1] Dr. R. P. Bigelow: The Anatomy and Development of Cassiopea Xamachana. Mem. Boston Soc. Nat. Hist. Vol. 5, 1900.

[2] Allman, Monograph on the Hydroids, p. 151.

With the single exception of the specimen represented in figure 1, which was the youngest larva showing any indication of multiplication, all the cases of budding which were observed agreed with the following account. As will be noticed, there are numerous points in which the process recalls the descriptions by previous writers of the budding of Rhizostome scyphistomas.

The first indication of budding in a polyp was the appearance of a rounded eminence upon the hydrocaulus, usually about half way between the base of the polyp and the ring of tentacles. In all the specimens observed the bud appeared interradially, i. e., not in line with the tentacles, but midway between them (Fig. 11). No polyp bore more than a single bud at a time. All three body layers of the parent are involved in the production of the bud. The cells of both ectoderm and endoderm multiply rapidly in the region of the wall of the polyp where the bud is about to be formed. The endoderm pushes out a rounded protuberance, and the ectoderm follows as a layer of constant thickness, a thin supporting layer of mesoglœa lying between the two. As the bud increases in size it bulges out at the base around the stalk-like connecting rod, and it also develops rapidly at the tip of the free end; in this way it becomes pear-shaped (Fig. 4). As the figures show, at this stage the ectoderm is as thick in the bud as in the parent polyp. Indeed, so nicely adjusted is the rate of growth of the two tissue-layers, that the thickness of the ectoderm appears not to vary in the least degree; the increase in amount of ectoderm from multiplication of the cells already incorporated in the wall of the bud and from immigration of cells from the parent is just sufficient to make up for the increase in amount of the endoderm. The cells of the latter layer are irregular, loosely constituted and coarsely granular, and their walls are hardly discernible. No cavity exists until later.

By rapid centrifugal growth the bud becomes sausage shaped, and as long as the diameter of the polyp (Fig. 11). The endoderm of the bud now becomes separate from that of the parent, the ectoderm constricting and cutting off the endodermal rod which fills it (Fig. 5). The bud is now united to the polyp by an isthmus of clear, noncellular elastic ectodermal tissue.

Soon after the bud reaches the stage of development shown in Fig. 5, it becomes detached. In only one instance was I so fortunate as to see this process taking place, as follows: the bud was drawn out into a long finger-like body, its distal end drooping almost to the bottom of the dish. Soon the ectodermal rod began to stretch out and dwindle in diameter to a thin stem of transparent protoplasm (Fig. 6). The bud seemed to be reaching out away from the parent, and stretching the connection. Although the tip was nearly resting on the bottom of the dish, it is out of the question to suppose that it was actually in contact with and fastened to the glass and that it was by this means pulling away from the parent. In fact, the distal end was seen to be free and moving with the rest of the bud as it elongated. This peculiar stretching of the connecting rod was evidently caused by the constriction of the outer layer of the ectoderm as if by encircling muscle fibres. When the connecting isthmus had stretched until it was a quarter as long as the whole bud, it began to grow still thinner at about its middle, and finally, just half an hour after the first signs of lengthening appeared, the bud fell away from the parent. The two drops of protoplasm which remained as remnants of the stalk, one on the bud and one on the wall of the polyp, soon shrank back into the adjacent ectoderm (Fig. 7).

After separation from the polyp, this particular bud settled down at once, and began its independent existence. Other observations, however, indicate that the usual course of development includes a period of from two to four days, intervening between the detachment of the bud and its settling down as a polyp, during which it swims about freely as a typical planula. A bud which was growing upon the body-wall of a polyp one day would be gone the next, and for some time could not be found. Then suddenly it would turn up in some previously vacant spot, at some distance from the polyp, with its new tentacles just beginning to develop. Careful drawings were made in two cases, accompanied by measurements, and the dishes containing the polyps were mapped at frequent intervals, to show the location of each individual. The exact period of planula life is uncertain, but it is at any rate extremely probable that it is a normal stage in the life-history of the non-sexually produced larva.

After separation from the parent, the developing bud repeats the ontogeny of the sexually produced individual. The newly arisen larva (Fig. 8), becomes shorter and thicker, and spreads out somewhat at the base on account of its soft protoplasmic substance. It is now firmly attached to the bottom, and the cells at its base have become long and columnar (Fig. 9). After the first day a slight pit is visible at the center of the distal end, as the first indication of the formation of the coelenteric system. By resorption of the endoderm cells, the tube is continued downward and finally enlarges into the gastric pouch.

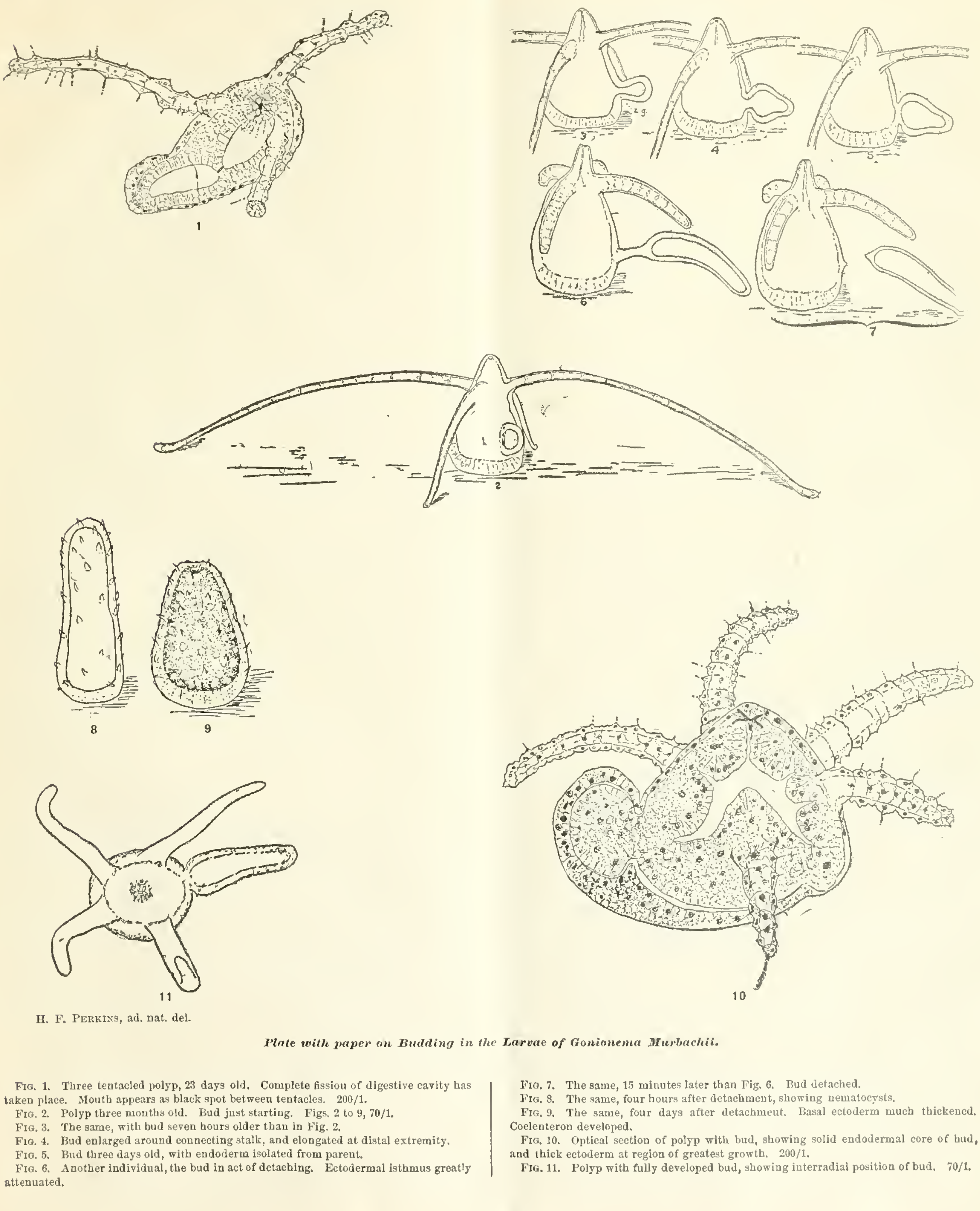
Partly by immigration along with the ectodermal cells of the parent hydrocaulus, and partly by subsequent development, a number of nematocysts have appeared on the surface of the bud, by the time it is ready to be detached. Fig. 8 shows a larva which has just been set free from the parent polyp, in which nearly fifty nematocysts are fully developed.

The length of time required for the complete development of a bud, from its first appearance as a round knob on the parent until the coelenteron is completed was from ten to fourteen days; (a) the first period, including as far as the detachment of the bud, five days; (b) free-swimming planula, two to four days; (c) from attachment to complete development of coelenteron, three to five days.

As soon as the gastric pouch is formed, the tentacles appear, first two, then a second pair, as in the sexually produced polyp. I hope to publish shortly an account of the general development of *Gonionema*, to include a section on the later development of the hydroid polyp.

SUMMARY:

1. A process of non-sexual multiplication by budding in the solitary larvae of a Hydromedusa is described for the first time.
2. Buds are produced singly, and become detached as planulae.
3. An instance of apparent transverse fission, in which the coelenteron had undergone complete division, is reported.
4. From the planula stage onward, the asexual larvae repeat the ontogeny of the sexually produced young.



H. F. PERKINS, ad. nat. del.

Plate with paper on Budding in the Larvae of Gonionema Murbachii.

FIG. 1. Three tentacled polyp, 23 days old. Complete fission of digestive cavity has taken place. Mouth appears as black spot between tentacles. 200/1.

FIG. 2. Polyp three months old. Bud just starting. Figs. 2 to 9, 70/1.

FIG. 3. The same, with bud seven hours older than in Fig. 2.

FIG. 4. Bud enlarged around connecting stalk, and elongated at distal extremity.

FIG. 5. Bud three days old, with endoderm isolated from parent.

FIG. 6. Another individual, the bud in act of detaching. Ectodermal isthmus greatly attenuated.

FIG. 7. The same, 15 minutes later than Fig. 6. Bud detached.

FIG. 8. The same, four hours after detachment, showing nematocysts.

FIG. 9. The same, four days after detachment. Basal ectoderm much thickened. Coelenteron developed.

FIG. 10. Optical section of polyp with bud, showing solid endodermal core of bud, and thick ectoderm at region of greatest growth. 200/1.

FIG. 11. Polyp with fully developed bud, showing interradial position of bud. 70/1.

NOTES IN MATHEMATICS.

INVARIANT RELATIONS OF TWO TRIANGLES.

By J. G. Hun.

With two plane curves of the same order, one given in points $a_x^n = 0$ and the other in lines $a_\xi^n = 0$, there is associated a triangle such that the polar of any one of the lines as to a_ξ^n acting on a_x^n is the line itself; and similarly for the points. For if we take the polar of a line $l_x = 0$ as to a_ξ^n and act with the result on a_x^n, we have a line which we can make $\equiv \lambda l_x$. Equating coefficients, we have a cubic in λ, the roots of which give the three lines of the desired triangle. It can be shown that the meets of these lines are such that the polar of any one as to a_x^n acting on a_ξ^n gives the point itself.

We shall consider the case where $n = 3$ and the two cubics break up into a three-point and a three-line respectively.

Let the three-line be $a_x^3 \equiv \alpha_x\ \beta_x\ \gamma_x$
and the three-point $a_\xi^3 \equiv a_\xi\ b_\xi\ c._\xi$

Let $b_\beta\, c\ \ + b_\gamma\, c_\beta \equiv (\beta\gamma \mid bc)$,

$$\overset{\alpha\beta\gamma}{\Sigma}(\beta\gamma \mid bc)\alpha_i \equiv (bc)_i$$

and $\overset{abc}{\Sigma} a_j\,(bc)_i \equiv B_{ij}$.

Then the polar of a line, l_x, as to the three-point acting on the three-line is,

$$\Sigma x_i\,[\,a_l\,(bc)_i + b_l\,(ca)_i + c_l\,(ab)_i\,] \text{ which we make} \equiv \lambda l_x.$$

Then we have three equations of the type

$$\sum_{j=1,2,3} l_j\, B_{ij} = \lambda l_i$$

which are consistent if

$$\Delta(\lambda) \equiv \begin{vmatrix} B_{11} - \lambda & B_{12} & B_{13} \\ B_{21} & B_{22} - \lambda & B_{23} \\ B_{31} & B_{32} & B_{33} - \lambda \end{vmatrix} = 0$$

$$\equiv \lambda^3 + I_1\lambda^2 + I_2\lambda + I_3 = 0,$$

where the I's have the following values:

$$I_1 = -\Sigma B_{11};\ I_2 = \Sigma \begin{vmatrix} B_{22} & B_{23} \\ B_{32} & B_{33} \end{vmatrix};\ I_3 = -\begin{vmatrix} B_{11} & B_{12} & B_{13} \\ B_{21} & B_{22} & B_{23} \\ B_{31} & B_{32} & B_{33} \end{vmatrix} = -\Delta D N,$$

$$\text{where } \Delta \equiv (\alpha\beta\gamma),\ D \equiv (abc) \text{ and } N \equiv \begin{vmatrix} (\beta\gamma \mid bc), & (\beta\gamma \mid ca), & (\beta\gamma \mid ab) \\ (\gamma\alpha \mid bc), & (\gamma\alpha \mid ca), & (\gamma\alpha \mid ab) \\ (\alpha\beta \mid bc), & (\alpha\beta \mid ca), & (\alpha\beta \mid ab) \end{vmatrix}$$

We shall now express, in terms of I_1, Δ, D and N, the conditions that certain invariant relations between the three-line and the three-point shall exist.

(1). The condition that the three-point shall be apolar to the three-line is $I_1 = 0$.

(2). The condition that the joins of the three-point shall be apolar to the meets of the three-line is $3N + \Delta D I_1 = 0$.

Take the three-line as the triangle of reference and send b and c into the absolute. Then the joins of a to I and J are to be apolar to the polar of the line at infinity as to the triangle: that is, to the maximum inscribed ellipse. Then the tangents drawn from a to this ellipse must be perpendicular, and so a lies on the director circle, whose equation is $3N + \Delta D I_1 = 0$.

(3). The condition that there shall be a conic through the three-point and apolar to the three-line is $\Delta D I_1 - N = 0$.

Take the three-line and b and c as in (2). Then the conic will be the apolar circle whose equation is $\Delta D I_1 - N = 0$.

(4). The condition that there shall be a conic touching the joins of the three-point and apolar to the three-line is $\Delta^2 N = 0$.

If the three-line and b and c are taken as in (2), the conic must be the apolar parabola whose focus is at a. The joins of the middle points of a triangle are lines of the apolar parabola. Then, since the focus lies on a circle through the meets of any three tangents, a must lie on the circle through the middle points of the sides and so on the nine-point circle whose equation is $N = 0$. Now the condition is satisfied if the three-line degenerates into three lines through a point, and so $\Delta = 0$ must be a factor in the final condition. Also the degree should be twelve in α, β and γ, and six in a, b and c. That is, the factor $\Delta^2 = 0$ should appear. Then the condition is $\Delta^2 N = 0$.

(5). The condition that there be a conic through the meets of the three-line and apolar to the three-point is $D^2 N = 0$. For, evidently, we need only interchange the Greek and English letters in (4).

(6). The condition that there be a conic through the three-point and the meets of the three-line is $\Delta^2(\Delta D I_1 + N) = 0$.

Take the three-line and b and c as in (2). Then a lies on the circum-circle whose equation is $\Delta D I_1 + N = 0$. But the condition is satisfied for $\Delta = 0$, and the degree of the condition should be twelve in α, β and γ and six in a, b and c. Then the condition becomes $\Delta^2(\Delta D I_1 + N) = 0$.

(7). The condition that there be a conic touching the three-line and the joins of the three-point is $D^2(\Delta D I_1 + N) = 0$. For, evidently, we need only interchange the Greek and English letters in (6).

(8). The condition that there be a point conic apolar to the three-point and to the three-line is $D^2(\Delta D I_1 + N) = 0$.

A point conic apolar to the three-point is of the form $\Sigma\mu_1(A_x)^2 = 0$, where the A's, etc , are the minors in D of the corresponding small letters. And a conic apolar to the three-line is of the form $\Sigma\lambda_1(\alpha_x)^2 = 0$.

If these two conics are identical, we shall have six equations homogeneous in the six quantities μ and λ. The condition that these equations are consistent is the same as the condition that the three-line and the joins of the three-point touch a conic. This we saw to be $D^2(\Delta D I_1 + N) = 0$.

By an interchange of the Greek and English letters we have the condition that there be a line conic apolar to the three-point and to the three-line.

Investigation shows that the degrees of these conditions are correct and that the conditions hold for the cases where the three-point or three-line degenerates.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

May 9, 1902.

The Lesson of the Grand Cañon of the Colorado. By Professor W. M. DAVIS, of Harvard University.

Philological Association.

April 18.—One hundred and ninety-eighth regular meeting. Professor Gildersleeve in the chair. Thirty-five members were present.

Characteristics of Luther's German Bible which Re-appear in the Authorized Version. By J. HOFMANN.

Ancient Egyptian Love Ditties. By C. JOHNSTON.

May 16.—One hundred and ninety-ninth regular meeting. Professor Gildersleeve in the chair. Twenty-five members were present.

The Forms of the Future Tense in Middle High German in their Use and Distribution. By H. KURRELMEYER.

On Some Greek Transliterations of Cuneiform Texts. By C. JOHNSTON.

Historical and Political Science Association.

April 4.

Rev. Thomas Bray. By B. C. STEINER.
Représentation des Minorités en Belgique. By E. J. BENTON.
Green's Oxford Studies. By J. J. CRUMLEY.
Burton's Crises and Depressions. By J. L. BOST.

April 18.

Reconstruction in South Carolina. By P. HOLLIS.
Stead's Anglo-Japanese Agreement, from the Japanese Point of View. By K. KODERA.
Merriam's Political Theory of Calhoun. By J. S. MOORE.

May 9.

Influence of the Wabash-Erie Trade Route upon the Old Northwest. By E. J. BENTON.
Frederiksen's Finland. By R. H. WRIGHT.
Price's Economics and Commercial Education. By T. B. MOORE.
Watson's Addresses, Reviews and Episodes. By T. J. STUBBS.
Younghusband's European Expansion in Asia. By J. F. BLEDSOE.

May 23.

Reconstruction in Virginia. By H. J. ECKENRODE.
Tendencies in Political Theory. By W. W. WILLOUGHBY.
Two Important Works in Mediæval History. By J. M. VINCENT.

Baltimore Naturalists' Field Club.

October 29, 1901.

The Habits of Fly Larvae. By C. GRAVE.
The Sand Crabs of Beaufort. By O. C. GLASER.

November 19.

Fresh Water Sponges. By R. P. COWLES.
Mountain Flora. By D. S. JOHNSON.

December 18.

Case-Worm Flies. By E. G. MARTIN.
The Parasitic Barnacle Dichelaspis. By R. E. COKER.

January 12, 1902.

Indian Remains in the West Indies. By J. E. DUERDEN.
Some New Ferns in the Baltimore Region. By C. E. WATERS.

March 11.

Vegetation of Sicily. By D. S. JOHNSON.
Some Results of the Recent Sleet Storm. By B. W. BARTON.

April 22.

Bryozoa in Druid Hill Park. By R. P. COWLES.
Algae Boring in Corals and Shells. By J. E. DUERDEN.
A Rare Plant in the Region of Baltimore. By J. H. BARNHART.

May 20.

Some Botanical "Finds" near Baltimore. By D. R. JOHNSON and D. N. SHOEMAKER.
Notes on the 17-year Locust. By E. A. ANDREWS.

The officers of the Field Club for the year are:

President.—Dr. E. A. ANDREWS.
Vice-President.—Dr. B. W. BARTON.
Secretary.—D. H. TENNENT.
Chairman Botanical Section.—Dr. D. S. JOHNSON.
Chairman Geological Section.—Dr. G. B. SHATTUCK.
Chairman Zoological Section.—Dr. CASWELL GRAVE.

CURRENT NOTES.

Professor GEORGE E. HOWARD gave two lectures on French History:—Monday, May 12, Turgot and the French Revolution; Tuesday, May 13, Mirabeau and the Constituent Assembly.

JAMES SCHOULER, LL. D., of Boston, author of a History of the United States under the Constitution, gave a course of four lectures on Wednesdays and Fridays, beginning April 16, on The Life of the People during the Revolution.

The topics considered were the social conditions, industries and civilization of the American colonies, during the period of the struggle for independence.

The UNIVERSITY EXAMINATIONS of UNDERGRADUATE CLASSES will be in progress, May 30, June 2, 3, 4 and 5.

The MATRICULATION EXAMINATIONS will be held, June 11, 12 and 13, and October 1, 2 and 3.

DEGREES will be conferred, Tuesday, June 10.

A volume has been published as a MEMORIAL of the late PROFESSOR ADAMS. It contains biographical sketches and tributes from various writers and a Bibliography of Publications by Graduates and members of the Department of History, Politics and Economics of the Johns Hopkins University from 1876 to 1901.

The following papers will appear in the series of STUDIES IN HISTORICAL AND POLITICAL SCIENCE FOR 1902.

I. **Western Maryland in the Revolution.** By B. C. Steiner. 30 cents.
II-III. **State Banks Since the Passage of the National Bank Act.** By G. E. Barnett. 50 cents.
IV. **Early History of Internal Improvement in Alabama.** By W. E. Martin.
V. **Trust Companies in the United States.** By George Cator.
VI-VII. **The Maryland Constitution of 1851.** By J. W. Harry.
VIII. **Political Activities of Philip Freneau.** By S. E. Forman.

Other papers will be announced later.

AMERICAN JOURNAL OF MATHEMATICS, Volume XXIV, No. 2 (April, 1902), contains the following papers:—

Canonical Form of a Linear Homogeneous Transformation in an Arbitrary Realm of Rationality. By L. E. Dickson.
A New Theory of Collineations and their Lie Groups. By H. B. Newson.
Infinitesimal Deformation of Surfaces. By L. P. Eisenhart.

UNIVERSITY CIRCULAR No. 159, now in press, will contain the programmes and announcements of the courses of instruction for the next academic year. It will be sent on application to the Registrar of the University.

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The Collected Physical Papers of Henry A. Rowland.

A volume containing the Physical Papers of Professor Henry A. Rowland, for twenty-five years Professor of Physics in the Johns Hopkins University, is now in preparation.

It will be issued under the editorial direction of a committee apointed for that purpose, consisting of President Remsen, Professor Welch and Professor Ames.

The book will contain Professor Rowland's articles and memoirs on physical subjects, together with his popular writings and addresses, numbering sixty in all. These have been collected from over twenty different magazines and journals.

The subjects treated in these papers cover a wide range. In Heat there is the great memoir on the Mechanical Equivalent of Heat, with several shorter articles on Thermometers. In Electricity and Magnetism there are the fundamental researches on Magnetization, on the Magnetic Effect of Electrical Convection, on the Value of the Ohm, on the Theory and Use of Alternating Currents, etc. In Light there are the renowned discovery and theory of the Concave Grating and the long series of investigations made in the field of Spectroscopy. Lists of wave-lengths will not be reprinted in this volume, as they are readily accessible elsewhere; and any subscriber of this volume may obtain by application to the Johns Hopkins Press, Baltimore, a copy of Rowland's "Preliminary Table of Solar Wave-Lengths." There will be, further, a description of Rowland's ruling engine, used for the making of gratings, details of which have never before been published.

The Memorial Address of Professor Mendenhall and a portrait of Professor Rowland will also be included.

The volume will be printed in royal octavo, bound in cloth, and will contain between six and seven hundred pages.

The price set is five dollars net per copy [$5.00; £1. 1.–0.; francs 26; marks 21] for orders sent in advance of publication.

Orders may be sent to

Professor Joseph S. Ames,
Secretary of the Committee of Publication,
Johns Hopkins University,
Baltimore, Maryland.

Studies in Honor of Professor Gildersleeve.

The Johns Hopkins Press has now ready a volume entitled *Studies in Honor of Basil L. Gildersleeve.* It contains 527 pages together with a photogravure of Professor Gildersleeve.

The volume is dedicated to Professor Gildersleeve in commemoration of the Seventieth Anniversary of his birth by his pupils.

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